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73RD AIR DIVISION

FINAL REPORT

PROJECT ADC/73AD/63-2

PROTOPROOF OF MSR CHECKOUT

PROCEDURES FOR SAAMA

1 March 1963

Prepared by:

4750 Test Squadron
(OPERATIONAL)
Tyndall AFB, Florida

4750TH TEST SQUADRON (OPERATIONAL)
UNITED STATES AIR FORCE
TYNDALL AIR FORCE BASE, FLORIDA

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FOREWORD

Project ADC/73AD/63-2 was assigned by the Air Defense Command letter ADOOP-WT dated 7 January 1963 in accordance with ADC Regulation 55-49, dated 28 September 1959.

The project was assigned to protoproof a new SAAMA checkout procedure for the Mission Simulator Recorder (MSR), RO-104/AJG P/N MDE 33245-301.

The procedure was evaluated in the 4756th A & E Squadron, MA-1 Maintenance Shop. Mr. Joseph H. Burgess, Hughes Aircraft Company CTSP, and MSGT George E. Barton, NCOIC, provided technical assistance. The assistance and cooperation of the above personnel is gratefully acknowledged.

This report is unclassified.

ABSTRACT

This project was assigned to protoproof an improved method (SAAMA) of bench checking the Mission Simulator Recorder (MSR), RO-104/AJG.

The existing procedure was unsatisfactory. As a result, many MB-1 racks on F-106A/B aircraft were not successfully qualified and excessive manhours were expended trouble-shooting aircraft systems and MSR's.

The new procedure provides inputs to the MSR which duplicates the aircraft system.

It provides the technician with a simple and reliable functional check of the MSR and eliminates excessive trouble-shooting time. The procedure takes a maximum of thirty (30) minutes.

Four minor changes to the procedure are recommended, and SAAMA has been requested to take action for their inclusion.

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INTRODUCTION

1. The existing procedures and adapter cable for bench checking the simulator recorder, RO-104/AJG, outlined in Paragraph 6-1 of T.O. 33D5-16-10-22, have not been completely satisfactory, for example: The MSR self test features will often indicate satisfactory operation when, in fact, some circuits are not operating properly. In addition, malfunctions in the self test circuit have caused wasted manhours in trouble-shooting the MSR components.

2. An improved MSR checkout procedure and adapter cable was provided by SAAMA.

3. Because SAAMA did not have the required armament test stand, their procedure was protoproofed at Tyndall AFB, Florida, under the supervision of the 4750th Test Squadron (Operational).

OBJECTIVES

4. Evaluate the procedure prior to inclusion in T.O. 33D5-12-43-111 to insure its correctness and clarity.

5. To report any deficiencies found and recommend corrective action.

6. To effect coordination with ADC and SAAMA in order to expedite the publication of an improved MSR checkout procedure.

DESCRIPTION OF TEST ITEM

7. The new checkout procedure will be accomplished on the 486166-100 Armament Test Stand, and will provide dynamic inputs from the weapon system through the use of a new adapter cable.

8. The complete SAAMA procedure can be referred to in Appendix I.

9. The MSR, often referred to as the McDonnell Simulator Recorder or as the Mission Simulator Rocket, provides a complete in-flight check and permanent record of the presence of preparation and firing signals which would be applied to an MB-1 during an actual attack run.

10. Three different types of attack (radar lead collision, radar pursuit and optical pursuit) are required to fully evaluate the inputs

from the MA-1 fire control system in the F-106A/B aircraft. These simulated attacks are particularly important in order to monitor the time-of-flight inputs (T_f).

11. The time-of-flight monitor circuit (camera lamps 1, 2, 4, 8, 16, 32 and 64) evaluates the timer ground signal from the aircraft fire control system and applies voltages to the appropriate indicator lights on the Polaroid Camera Assembly. One, several, or all of these lights can be fired during an attack run. The sum of the numbers present for one attack can be translated into time-of-flight in seconds by referring to Figure 1-2 in T.O. 33D5-16-10-22.

12. A complete description of the MSR can be found in T.O. 33D5-16-10-22. Additional reference material can be found in the following T.O.'s:

T.O. 1F-106A-2-15 dated 20 January 1961

T.O. 1F-106A-2-27-6 dated 2 January 1962

T.O. 11F1-MA-1-12-7 dated 15 September 1961

T.O. 33D5-12-43-111 dated 1 June 1961

TEST RESULTS

13. The objectives of the protoproof test were accomplished.

14. The complete bench check procedure requires a maximum of thirty (30) minutes. This includes positioning the MSR on the test stand, connecting the adapter cable, and consulting T.O. 11F1-MA-1-12-7.

15. The new procedure provides the technician with a simple and reliable functional check of the MSR. Most important, it eliminates trouble-shooting of MSR component malfunctions when, in fact, the malfunctions occur in the MSR self test circuits.

16. The proposed SAAMA MSR checkout procedure is fully adequate with the following exceptions:

a. Eliminate Step K(1), (4), and (5). These steps are redundant as they have been accomplished in Step D.

b. Eliminate Step K(2) which refers to the nose wheel well door switch in the open position. It is necessary that the nose wheel well door switch be in the closed position in order for the subsequent steps to be accomplished.

c. Steps J and N(1) refer to sample Polaroid film as an attachment to the procedure. It is imperative that these samples be attached to the published procedure.

17. Time-of-flight readout numbers had minor variations, thus indicating the existing Air Force publications may be difficult to interpret.

CONCLUSIONS

18. The SAAMA procedure will provide an improved method for bench checking the MSR when the recommended changes have been made.

19. The new procedure will decrease the manhours required to trouble-shoot the MSR.

20. The existing T.O.'s pertaining to the MSR checkout procedures may be inadequate, i.e., it is difficult to determine the time-of-flight numbers and tolerances, if any.

RECOMMENDATIONS

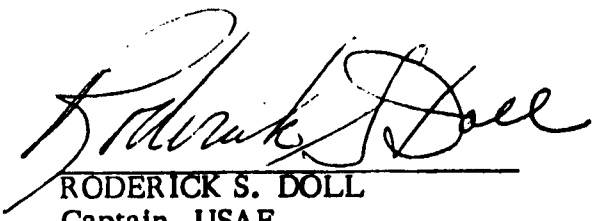
21. The MSR checkout procedure on the 486166-100 Armament Test Stand revised as per this report be published at the earliest opportunity.

22. A sample Polaroid film containing the applicable time-of-flight readout number and tolerances be included as part of the procedure and/or that the applicable number be included at the end of each step.

23. SAAMA insure the time-of-flight numbers and tolerances, if any, are correct prior to publication.

24. The new adapter cable be bench checked for proper continuity prior to production. Action has been taken by this organization and SAAMA to accomplish this task.

PREPARED BY:



RODERICK S. DOLL
Captain, USAF
Project Officer

REVIEWED BY:

ALVIN G. MOORE
Major, USAF
Commander
4750th Test Squadron (Operational)

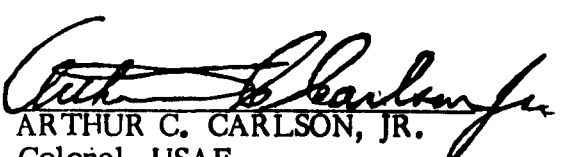
REVIEWED BY:

R. W. HOLMES
Colonel, USAF
Deputy for Operations & Training
4756th Air Defense Wing (Training)

REVIEWED BY:

KLEM F. KALBERER
Colonel, USAF
Commander
4756th Air Defense Wing (Training)

APPROVED BY:



ARTHUR C. CARLSON, JR.
Colonel, USAF
Vice Commander
73rd Air Division (Weapons)

DISCUSSION

1. The procedure was evaluated on the 4756th A&E Squadron's MA-1 mockup, during the evenings, due to the limited availability of -301 MSRs. During the period of evaluation, there was only one servicable -301 MSR, due to lack of parts, available at Tyndall. As a result, the procedure was evaluated using only one MSR.

2. Six (6) qualified Weapons Control System personnel individually evaluated the new procedure and their composite qualitative recommendations are included in this report.

3. The procedure had minor deficiencies as follows:

a. Step K(2) requires the nose wheel well (NWW) door to be in the open position. This switch position (K(2)) was in error as the NWW switch must be in the closed position to provide continuity for the remainder of the test. The NWW switch was previously (Step E(6)) set to the proper closed position and was not changed prior to Step K(2). As a result, the procedure can be corrected by merely deleting Step K(2).

b. That Steps K(1), K(4), and K(5) were superfluous. These switches were previously set to this same position during Step D and were not changed by the subsequent steps.

c. The time-of-flight readout numbers provided by SAAMA (reference Paragraph 7) and those provided by HAC (Tyndall) (refer to Paragraph 9E) have minor variations and indicate that the existing Air Force Publications may be difficult to interpret.

4. The new cable to adapt the MSR to the armament test stand did not arrive with the procedure. The lack of an adapter cable did not delay the procedure checkout as the MA-1 shop, at Tyndall, had previously constructed their own adapter cable and were using a dynamic checkout procedure similar to the SAAMA one.

5. To ensure that the SAAMA adapter cable performs its function satisfactorily, SAAMA will provide this organization with their cable at a later date for final evaluation.

6. The sample Polaroid film referred to in Steps J(2) and N(1) of the SAAMA MSR Checkout Procedure on the 486166-100 Armament

Test Stand was not available for the evaluation. The samples were to be used to correlate the parameters set and printed at the completion of the optical, lead collision and abort checks.

7. The SAAMA print had the following time-of-flight readout numbers. (Note: No tolerance allowed.)

Reticle Selection	Time-of-Flight Number
1	6
2	16
3	52
4	61

Lead Collision	Time-of-Flight Number
1	52
2	92

8. HAC (Tyndall) provided T_f readout numbers for the procedure evaluation. The numbers were not identical with those provided by the SAAMA print, however, the SAAMA T_f numbers did fall within the tolerances provided by HAC.

9. To substantiate Tyndall's findings on the proposed checkout procedure of the MSR on the MA-1 Armament Test Stand, P/N 486166-100, the following is offered:

a. Although T.O. 1F-106A-2-27-6, dated 2 January 1962, revised 30 March 1962 is written for aircraft use, the majority of its content is applicable to the test stand operation and the checkout of the MSR.

b. The only acceptable T_f readout numbers from the MSR when used with the MA-1 system are as follows: 7, 17, 26, 35, 44, 53, 61, 69, 77, 84, 91, 98, 105, 112, 119, and 126 (reference Figure 6-11 in T.O. 1F-106A-2-27-6). These sixteen steps correspond to the precision voltages available from the 464087 unit. The actual output to the MSR is dependent on the state of four T relays which will give a total of 16 possible combinations from the energized or de-energized states of each relay.

c. Optical Reticle Selection: The switch positions on the 166 test stand correspond to the Optical Sight Reticles selected as follows:

Sw. Pos.	O. S. Reticle	T_f Number
1	0 - 18,000 ft.	1 - 17
2	18,000 - 36,000 ft.	7 - 26
3	36,000 - 47,000 ft.	35 - 61
4	47,000 ft. up	44 - 69

d. For pursuit conditions, T_f is dependent on target altitude and can result in only four time-of-flights (Para. 6-20). Figure 6-12 shows the above target altitudes and the corresponding T_f's. This figure is for a condition whereby the MA-1 computer dictated the target altitude. Due to system tolerances, the MSR can print the center step number plus or minus one step (Para. 6-18). This is due to the possible errors in the digitizing process. In addition to the MA-1 system of tolerance of ± one step, the MSR recorder has a tolerance of ± one (1) time-of-flight number.

e. If the optical sight itself or the test stand switch is used to set the T_f, this tolerance of ± step cannot be counted. There will be no possible errors in transposition of air data (not applicable) or the digitizing process as the selection itself will determine directly the combination of the four relays in the 464087. Consequently, the voltage ratio applied to the MSR will not vary from system and the only tolerance applicable will be within the MSR due to the recording process amounting to ± one time-of-flight number. The time-of-flights set on the test stand should be as follows if all components are operating properly:

Reticle Select	Time-of-Flight Number
1	7 ± 1
2	17 ± 1
3	53 ± 1
4	61 ± 1

f. The same condition exists for the lead collision checkout on the test stand. No variations should exist due to air data or system digitizing errors as the combinations of time-of-flight setting relays are fixed and changed only by selecting parameter set #1 or #2.

g. Parameter set #1 selection energizes relays K_2 and K_4 in the 464087 unit resulting in a T_f number of 53 ± 1.

h. Parameter set #2 selection energizes relays K_2 and K_4 resulting in a T_f of 91 ± 1.

APPENDIX I

SAAMA Recommendations for MSR Checkout on 486166-100 Armament Test Stand

A. Set MSR on 166 Stand.

B. Open film door, lift Camera Film Cutter to see how many pictures are left on roll.

C. Inside film door, check to see that all four (4) ABORT switches are in the OFF position.

(1) Disconnect P801 from the Rocket Voltage Checker on the 166 Stand, plug in proper connector and other three connectors on MSR.

D. Set 166 Stand and Unit Controls to the position indicated in T.O. 11F1-MA1-12-7, Figure 6-5.

E. Put normal power to 166 Stand. (Await time in.)

(1) Push Home Button in MSR. (See that Home Light is on.)

(2) Set Lead Collision-Pursuit Switch to Pursuit (596).

(3) Arm-Safe Switch to Arm (Armament Control Panel).

(4) Lock-Unlock Switch to Unlock (Armament Control Panel).

(5) Optical Sight Stowed-Not Stowed to Not Stowed (166 Stand).

(6) NWW Door Open-Closed Switch to Closed (166 Stand).

F. Select Optical Retical #1 (166 Stand).

(1) Select SPL WPN (Armament Control Panel, Wait for leaders to stop stepping).

(2) Trigger on (166 Stand) (NOTE: Pads retract, No in ACP window, Doors Open and Doors Closed light on).

(3) Trigger off.

(4) Recycle Inter-Valometer (Armament Test Stand 166).

(5) Return ACP to VIS-IDENT. (Pass One Completed)

G. Select Optical Retical #2.

(1) Repeat steps F(1) thru F(5). (Pass two completed).

H. Select Optical Retical #3.

(1) Repeat steps F(1) thru F(5). (Pass three completed).

J. Select Optical Retical #4.

(1) Repeat steps F(1) thru F(5). (Pass four completed).

(2) Home Leadex NOTE: Process film as directed on camera. Picture should be as sample, if so, procede to step K.

K. Optical Sight Stowed-Not Stowed Switch to Stowed.

(1) Parameter set to #1.

(2) NWW Door to Open.

(3) Set 596 to Lead Collision.

(4) Set 596 to Manual.

(5) Set 596 to ATS.

(6) Set 796 to Test Position #6.

(7) Set Trigger to ON.

(8) Select SPL WPNS.

(9) Set B Normal Switch to "B". (Wait approx. 10 seconds).

(10) Set C Normal Switch to "C". (Wait approx. 10 seconds).

(11) Set E Normal Switch to "E". (Should see NORMAL FIRE Signals for SSGC #6).

(12) Return E, C, and B switches to normal, in order, starting with E, C, then B.

(13) Reset Inter-Valometer.

(14) Select VI. (This completes Pass #1, Parameter #1 settings).

L. Set Parameter Switch to #2.

(1) Repeat steps K(8) thru (14). (Pass #2, Parameter #2 completed).

M. Set Pass three abort switch in MSR to ON ABORT.

(1) Repeat steps K(8) thru (14). (Pass #3, Abort completed).

N. Turn Abort Switch to OFF.

(1) Process Film (Should be as sample).

(2) Home Leadex.

(3) Turn all power switches to OFF on 166 Stand before disconnecting MSR.

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